Passive and Active Microwave Transfer (PAMTRA)

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Forward models are a key tool to compare observations and models by converting the output of atmospheric numerical models to synthetic observations. They are also an integral part of inversion algorithms that aim to retrieve geophysical variables of interest from observations.

Here, the comprehensive microwave forward model PAMTRA (Passive and Active Microwave TRAnsfer) is introduced, which can simulate passive and active measurements across the microwave spectral region up to 800 GHz. The passive forward model in PAMTRA provides up- and down-welling polarized brightness temperatures and radiances for arbitrary observation angles, while the active forward simulator is capable of simulating radar Doppler spectra and their moments. Both can be applied to arbitrary plane-parallel atmospheric scenes, including those with complex hydrometeor assumptions. PAMTRA implements various gas absorption models and methods for the approximation of the scattering properties (Mie, T-matrix, DDA, self-similar Rayleigh-Gans) and uses the same for the passsive and active forward simulations. The core module is written in FORTRAN90, whereas the framework and user interface are python based. Therefore, it the model is easy to use and extendable.

Furthermore, various applications from recent studies where PAMTRA has been applied will be shown.